Faculty Working Papers

PRICING OF LIQUIDITY FOR PREFERRED STOCKS ON
THE NEW YORK STOCK EXCHANGE

Frank K. Reilly, Professor, Department of Finance

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College of Commerce and Business Administration
University of Illinois at Urbana-Champaign

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TESTING THE CASH-FLOW RELEVANCE OF THREE CONCEPTS OF PROFIT

Robert F. Sharp, Assistant Professor, Department of Accountancy
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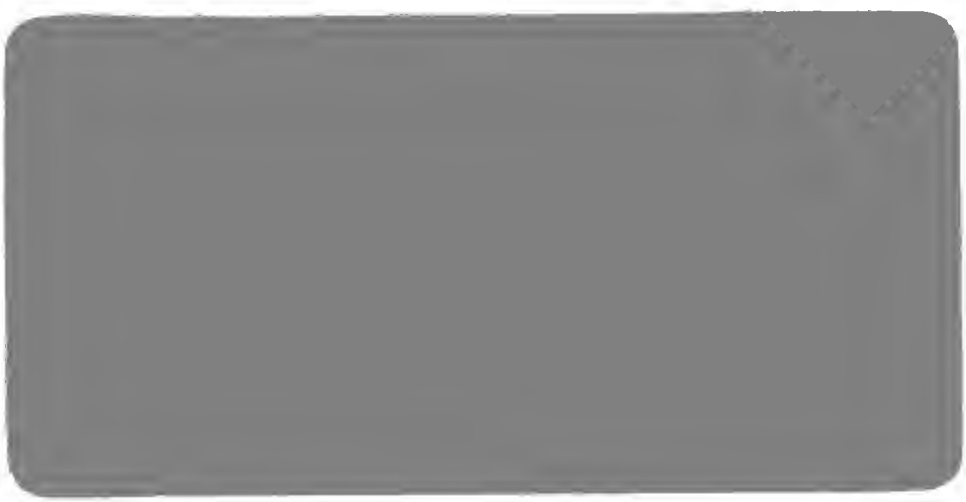

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March 26, 1980

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Summary

This study investigates the possibility that "nominal (current-cost) profit," "physical profit" or "general-purchasing-power" profit could be relevant for predicting a firm's operating cash flow. A preliminary set of computer simulations is used to select a theoretically justifiable prediction model and to demonstrate (a) that both nominal profit and general-purchasing-power profit would generally not be relevant for such predictions and (b) that physical profit is potentially relevant. This potential is then tested by employing a more realistic simulation technique which substitutes industry-average data for the assumed data used in the preliminary simulations. As a result of variations in the external price data, the final simulation produces a highly erratic cash-flow series, providing a more rigorous test.

The final results confirm the predictive relevance of physical profit only in the sense of its forecasts being unbiased. In spite of having an insignificant mean error of only 6%, the physical profit forecasts have absolute deviations averaging 72% of future cash flows. (Nominal profit and general-purchasing-power profit have larger absolute deviations, and their biases vary across firms with different financing structures.) The latter part of the paper suggests possible approaches for overcoming the problem of absolute deviations and for investigating the relevance of these profit concepts for predicting other criteria of interest to investors.

CONTENTS

INTRODUCTION.. 1

CONCEPT DEFINITIONS... 3

Specification of the Predictors.......................... 3

Relation to Previous Studies............................. 5

Clarification of the Criterion........................... 6

THE RESEARCH DESIGN... 6

Preliminary Input Controls............................... 7

Hypothesized Prediction Models........................... 10

Preliminary Results...................................... 12

Interim Summary.. 14

Tax Effects.. 15

Final Research Design.................................... 16

FINAL TEST RESULTS.. 19

SUGGESTIONS FOR FUTURE RESEARCH............................... 21

SUMMARY... 23

TABLES.. 25

FIGURES... 28

FOOTNOTES... 35

REFERENCES.. 37

TESTING THE CASH-FLOW RELEVANCE

OF THREE CONCEPTS OF PROFIT

In its first Statement of Financial Accounting Concepts, the Financial Accounting Standards Board (FASB) focuses on the potential usefulness of reported earnings to investors and creditors. [1978: pp. viii-ix] In a general sense, according to the FASB, "Financial reporting should provide information that is useful to present and potential investors and creditors in making rational investment, credit, and similar decisions." More specifically, such information would help these investors and creditors "in assessing the amounts, timing and uncertainty of prospective cash receipts" due to their particular associations with the reporting firm. Cash flows to these external users are presumed to be dependent on the firm's cash flows, and, therefore, the information should help these users "assess the amounts, timing and uncertainty of prospective net cash inflows to the related enterprises"; the immediate object of prediction is <u>the firm's</u> future cash flows. The most relevant information for predicting the firm's future cash flows, according to the FASB, is past earnings information, rather than information about the firm's past cash flows. Thus the FASB concludes, "The primary focus of financial reporting is information about earnings and its components." [p. ix] Accordingly, the FASB has encouraged systematic investigation of the relationships between earnings and cash flows.

While we are willing to stipulate that the ability to predict cash flows would be useful and that past "earnings" might be more relevant than past cash flows for this purpose, we note several problems that must be overcome in order to achieve the FASB's objectives. Major among these problems are (1) the definition of "earnings," or

"profit," (2) specification of the prediction model in which "profit" is but one variable and (3) choosing a research technique that is appropriate for testing the relationships between alternative concepts of profit and a firm's future cash flows.

The objectives of this study are to develop a general research design that is responsive to these problems and to provide tentative evidence on the issue of predictive relevance. Based on general description of three concepts of "capital" mentioned in recent accounting literature, we define three performance attributes as potentially relevant predictors:

1. nominal (replacement value) profit;
2. physical profit; and
3. general-purchasing-power profit.

We then employ two types of computer simulation to determine (1) the restrictive conditions under which one or more of these performance attributes would be perfectly predictive of a firm's cash flows and (2) the approximate predictive relevance of each performance attribute when the firm's performance is affected by environmental uncertainties. We find that nominal profit and general-purchasing-power profit are not relevant for predicting a firm's cash flows; predictions based on physical profit are unbiased but subject to large absolute errors. Based on the analysis and test results, we offer some suggestions that may be helpful in conducting future research on the general issue of predictive relevance.

The scope of this study does not include all types of relevance. Information about past performance could also be relevant for many types of control decisions, as feedback for comparison with past expectations. While not directly addressed in this study, the issue of "control relevance" might be investigated by using a similar research design.

CONCEPT DEFINITIONS

For the prediction of cash flows, we have chosen to compare three major concepts of profit that might be measured through use of a current-cost accounting system. Each of these three concepts is a distinct performance attribute that can be defined verbally and as a mathematical expression containing only resource quantities and their purchase prices. The latter approach allows us to avoid the possibility of specification errors in some of the many resource/expense/ adjustment models that have been advocated, explicitly or implicitly, for estimating each of these performance attributes. The reader may also find this approach helpful in distinguishing the meanings of these three types of performance.

Specificiation of the Predictors

The first of these performance attributes is merely the change in nominal replacement value (RV) of resources as a result of operations. Assuming no financing activities (and no dividends),

$$\text{nominal profit} = \sum_r RV_{r,t} - \sum_r RV_{r,t-1}$$

$$= \sum_r [Q_{r,t} P_{r,t} - Q_{r,t-1} P_{r,t-1}]$$

where $Q_{r,t}$ = the quantity of resource r held at the end of year t,

$P_{r,t}$ = the purchase price of a unit of resource r at the end of year t.

If there were additional external financing, that amount would be deducted (and dividends would be added). Although conceptually simpler, the above specification is mathematically identical to the "Business Profit" model of Edwards and Bell. [1961: Ch. III] Nominal profit is the amount a firm could distribute while maintaining the nominal replacement value of its beginning resources.

Nominal profit is affected by both physical changes and price changes. A firm that had no physical changes during the year could still have a nominal profit, resulting solely from price changes:

$$\Delta P = \sum_r [Q_{r,t-1}(P_{r,t} - P_{r,t-1})]$$

Isolating and deducting these price changes produces

$$\text{physical profit} = \text{nominal profit} - \Delta P$$
$$= \sum_r [Q_{r,t} - Q_{r,t-1})\, P_{r,t}].$$

This second performance attribute is approximated[1] by the "Current Operating Profit" calculation of Edwards and Bell [1961, Ch. III]. Physical profit is the amount a firm could distribute while maintaining the ability to replace the resources consumed since the beginning of the year.

General-purchasing-power profit, the third performance attribute to be tested, can also be viewed as a component of nominal profit. In terms of general purchasing power, a firm would "break even" if its owners equity (OE) changed by the percentage change in the Consumer Price Index (CPI),[2] i.e., if nominal profit equals ΔG, where

$$\Delta G = OE_{t-1}(CPI_t - CPI_{t-1})/CPI_{t-1} .$$

General-purchasing-power (GPP) profit would be the excess of nominal profit over this break-even amount, or

$$\text{GPP profit} = \text{nominal profit} - \Delta G .$$

This final specification is similar[3] to Edwards and Bell's "Real Business Profit." [Ch. VIII] GPP profit is the amount a firm could distribute while maintaining the general purchasing power of beginning owner's equity.

Relation to Previous Studies

The present research differs in both its purpose and its design from previous studies of alternative concepts of profit (or income numbers). The ability to predict future income numbers has been addressed using reported data (e.g., Frank, 1969; Buckmaster, Copeland and Dascher, 1977) and simulated data (e.g., Simmons and Gray, 1969). Simulation has also been used to evaluate income numbers with respect to managerial ability (e.g., Picur and McKeown, 1979) and accuracy in representing another income concept (e.g., Greenball, 1968). Numerous market studies have investigated the use of historical-cost earnings per share in predicting total market returns, including gains in the market price per share.

But none of these earlier studies has directly addressed the relevance of any type of profit for predicting a firm's cash flows. Indeed, it is necessary to analyze the meaning of this latter criterion.

Clarification of the Criterion

Without some further clarification, a "cash-flow" criterion could be measured many different ways. The FASB states that accounting users "are directly concerned with the ability of the enterprise to generate favorable cash flows." [1978: SFAC-1, p. 11] But cash flows can be affected by financing activities and investing activities, in addition to cash flows generated by operations. We assume herein that "favorable cash flows" are those generated by operations only, exclusive of additional financing and before dividend payments. Our assumption further implies that cash flows resulting from disinvestment (reducing the firm's operating level) would be excluded in measuring "favorable" cash flows. A final point for consideration is the nature of cash outflows for interest payments. While such amounts are often called "financing expenses," they seem to be the cost of operating temporarily with another's monetary capital in the same sense that rent is a cost of operating temporarily with another's nonmonetary capital. Because of this similarity, and because all three of our profit concepts imply a reduction for interest expense, we also deduct interest payments in computing the cash-flow criterion.

THE RESEARCH DESIGN

In addition to addressing a different research question, our research design also differs from those of previous studies. A purely empirical study is not presently possible due to limitations in reported data. The three types of profit to be tested are not presently reported, and attempts to adjust the reported data could introduce measurement errors that we wish to avoid. The desired experimental control is maintained by using two different versions of computer simulation. In the analytical portion of the study, we use a familiar type of simulation in which all inputs are controlled by the researcher. This procedure allows us to determine the restrictive conditions under which one or more of the three performance attributes could be used to make perfect predictions of future cash flows. A necessary part of this initial task is the specification of a simple but conceptually justifiable prediction model. In effect, the fully controlled simulations serve as a pilot study for developing the hypothesis that is tested in the final simulation. In the final simulation, six real-world price series are substituted for the initial set of controlled price changes. This technique has not been used in previous studies of predictive ability. While the external data results are more realistic than the assumed-data results, they are also more complex. We expect that the discussion of the assumed-data results will aid the reader in understanding the more complex results that follow.

Preliminary Input Controls

One of the major difficulties that confronted us in this study is the absence of a theory that explains future cash flows in terms of _any_ type of past performance.[4] It would seem that past performance would be affected by past resources and past managerial expertise plus a host of past environmental factors. And future cash flows would be affected by future managerial expertise plus a host of future environmental factors, in addition to the level of resources at the beginning of the period to be predicted. Thus, unless we know that the future will always be like the past, there may be no reason for believing that past performance is predictive of future cash flows (or future anything). If there is a change in beginning resources, managerial expertise, product demand, output prices or input prices, future performance will differ from past performance. If there is any relationship between "performance" and cash flows, cash flows will also change as one or more of the above factors changes.

This suggests that the ability to predict cash flows may be dependent on all of the conditions of a stable equilibrium. That is, all of the factors that affect performance and cash flows must be stable from one operating period to the next. In such a complete equilibrium, however, we would have nothing to investigate: if all prices were in equilibrium, the three performance attributes would have equal magnitudes, and they would have equal predictive relevance. Thus we pass over this trivial case.

Instead, our initial assumption is that all prices affecting the firm are changing at a stable rate of 4% per annum,[5] approximately one-twelfth that amount per month. Except for price changes, most other factors (shown in the upper half of Table 1) are held constant over time. For all of the simulated firms, output and gross resource levels are constant from one year to the next. Goods sold during each month are exactly replaced at the end of that month. Equipment ages vary initially from zero to nine years, and the oldest unit is replaced at the end of each year of operation. Buildings are rented under operating leases, with rents equal to a constant percentage of sales revenues. The year-end cash balance, after replacement purchases, is distributed to stockholders. There are no accounts payable or receivable, no intangible assets and no interperiod tax allocations, all of which might confuse any differences between cash flows and the performance attributes.

In addition to these common conditions, other conditions are subjected to different experimental controls for the first four firms. These experimental controls are (1) dividend policy, (2) financing policy, and (3) income taxes. Both the common factors and the specific factors are outlined in Table 1.

The only empirical data used in these preliminary simulations are the ratio constraints shown in Table 1. The relative effects of inventories and equipment on both performance and cash flows can be manipulated unless the first three of these ratios are somehow constrained. Because the price data used in the final simulation are applicable to the retail clothing industry, we have selected the preliminary ratio constraints from the same industry. They are averages of the ratios reported by Robert Morris Association (RMA) for Men and Boys Clothing over the past ten years. The total RMA ratio for depreciation and rent (.052) has been allocated half to equipment depreciation and half to building rent. The last ratio is the inventory "turnover," which is used for scaling the sales relative to the inventory level.

The four preliminary cases, which may also seem trivial at first glance, are necessary for understanding how differences in financing structures and income tax rates can significantly affect the relative size and variability of the predictive errors. Although not reported herein, similar results were obtained from eight additional cases. Thus we feel that the four cases reported below are sufficient for demonstrating how the final hypothesis was developed.

Hypothesized Prediction Models

As mentioned above, the predictive relevance hypothesis must include a specification of the prediction model. We wish to find a simple prediction model that employs only the type of data that could be found in the firm's present and past financial statements, if the firm were reporting the performance attribute being tested. If possible, we do not wish to include unreported data or future environmental data to which we have access but which would be unknown to an external party at the time of making the prediction.

Given this constraint, our general hypothesis is based on the following assumptions.

a. Cash flows are proportional to one of the three performance attributes.

b. Performance is proportional to the level of resources with which the firm operates.

c. The monetary magnitude of performance is proportional to the monetary magnitude of the resource level.

From these assumptions, we derive a general form of the null hypothesis:

$$H_0: \text{ Profit}_{i,t} \left(\frac{\text{Level}_{j,t}}{\text{Level}_{j,t-1}}\right) - \text{Cash Flow}_{t+1} = 0.$$

$$\text{where } i = \begin{cases} 1: & \text{nominal profit} \\ 2: & \text{physical profit} \\ 3: & \text{GPP profit} \end{cases}$$

$$\text{and } j = \begin{cases} 1: & \text{total assets (deducting depreciation)} \\ 2: & \text{net assets (total assets minus debt)} \\ 3: & \text{gross capacity (total assets plus depreciation)} \\ 4: & \text{net capacity (gross capacity minus debt)} \end{cases}$$

All four specifications of operating level are tested below to discover which one produces the minimum prediction errors for all three performance attributes across the first four firms. The results of these initial tests determine the final specification of the hypothesis to be tested in the case of empirically determined price changes.

Preliminary Results

For Firm 1, we found that all four prediction models produced the same results for each of the three performance attributes. Since there is no debt, total assets equal net assets and gross capacity equals net capacity, at any given moment. Since accumulated depreciation is a constant percentage of equipment cost (new), $\text{level}_t/\text{level}_{t-1}$ is always 1.04, under any of the four specifications for "level."

As shown in Figure 1, physical profit and GPP profit provide perfect predictions of Firm 1's cash flows, while nominal profit overpredicts by a constant 65%. Physical profit, often referred to as "distributable profit," does equal actual dividend distributions when dividends are equal to the operating cash flows (cash flows not affected by changes in financing or operating level). Since both the monetary operating level and cash flows increase 4% each year, physical profit is also perfectly predictive of future cash flows and future dividends. Because nominal profit includes price changes that are not distributable, it overestimates cash flows contemporarily as well as predictively. GPP profit is equal to physical profit when all prices change by the same percentage each year and when net monetary items equal zero.

Figure 2 indicates the effect of net monetary liabilities on GPP profit. Since half of Firm 2's initial financing was borrowed, ΔG is only half as much as ΔP for 1949, and GPP profit has an error equal to half the error of nominal profit. Thereafter, since the nominal amount of owner's equity increases relative to the constant amount of debt, ΔG becomes a larger fraction of ΔP, and the errors for GPP profit become a smaller percentage of cash flows. These errors decrease from 39% to 9% of cash flows.

Physical profit provides nearly perfect predictions, however, with the smallest errors (0.04%) occurring when "level" is defined as net capacity. Due to an increasing monetary amount for total assets or gross capacity and a constant amount of debt, cash flows and performance increase at an increasing rate, greater than 4% per year; interest payments become a smaller percentage of cash inflows from sales. As a result, the 4% change in total assets and gross capacity both underestimate the change in cash flows. Disregarding the possibility of reduced output or higher maintenance cost as a function of age, a firm's net cash flows would be a function of its return on gross capacity less its debt payments. Thus the change in cash flows would be approximated more closely by the net capacity ratio than by the net assets ratio which includes a deduction for accumulated depreciation. We suspect that this relationship may also hold when equipment age is a factor, but we did not test this latter hypothesis.

Another reason why the GPP errors, and the nominal errors, become smaller percentages over time is that the cash flows are an increasing percentage of sales. Interest expense is a declining percentage of sales. The nominal profit errors are caused by the price changes (ΔP), which are a constant percentage of sales. With the cash-flow denominator growing faster than nominal-error numerator, the percentage errors for nominal profit decline over time, from 77% to 56% of cash flows. The declining errors for GPP profit are a combined function of a declining monetary-liability effect in the numerator and a denominator that is growing as a percentage of sales.

The error growth rates are somewhat reversed in Figure 3. As a result of forcing Firm 3 to distribute its nominal profit, the firm is also forced to borrow an amount equal to its annual price changes (ΔP). Due to the increasing interest expense, cash flows become a smaller percentage of sales. Consequently, the nominal profit errors increase from 45% to 83% of cash flows. For GPP profit, the errors increase from near zero to 55% of cash flows, primarily due to an increase in the relative size of the net monetary liability. GPP profit only "maintains" the purchasing power of owners' equity, which decreased from 100% to 31% of total assets.

It may also be worth noting that nominal profit provided excellent predictions of Firm 3's dividends. Approximately 69% (45% to 85%) of annual dividends were borrowed, but nominal profit predicted them with a fairly consistent error of -1.15%, using net capacity in the prediction model. It should be remembered, however, that payment of such dividends contracted the firm's net resources; over a thirty-year period, debt increased from zero to 69% of total assets--when prices were only increasing 4% per year!

For predicting operating cash flows, however, physical profit was again superior. Although the errors were slightly larger than before, they were all less than half a percent when net capacity was used in the prediction model. As in the case of Firm 2, and for nominal profit in predicting Firm 3's dividends rather than cash flows, net capacity provided better predictions than the other three specifications for operating level. Table 2 shows comparative errors for the alternative prediction models for these cases. ("Level" makes little or no difference in the other cases.)

Partial Summary

At this point, we are reasonably certain that physical profit is more relevant for predicting a firm's cash flows than are the other two performance attributes. GPP profit produces erroneous predictions whenever a firm has net monetary liabilities, a condition which often occurs in the real world. (GPP profit could also produce predictive errors when the consumer price index changes at a rate different from changes in prices of the firm's resources.) Nominal profit, because it includes nondistributable price changes, would never be relevant for predicting a firm's operating cash flows, unless prices stop changing.

Physical profit would underpredict "residual" cash flows if part of operating cash flows were used to expand resource levels, and it would overpredict this residual in the case of a contraction. If firms are expanding in general, physical profit would have a positive bias with respect to such residual flows, but the bias would be significantly smaller than those of nominal profit and GPP profit.

Thus, for predicting operating cash flows or residual cash flows, we hypothesize with some confidence that physical profit will generally be the more relevant of the three attributes tested in this study. But we have not yet determined whether physical profit would be relevant for such predictions in more realistic settings. It could be _more_ relevant than the others but not relevant _enough_ to make any practical difference to real-world decision makers. This issue is addressed below, first by relaxing the income tax assumption and then by relaxing the price change assumptions.

Tax Effects

Figure 4 gives some indication of how cash-flow predictions could be confounded by income taxes based on historical-cost income. As the average historical cost of equipment gets older, from zero in 1948 to five years in 1958, the depreciation deduction becomes a smaller percentage of sales, taxes become a larger percentage of sales, and operating cash flow becomes a smaller percentage of sales. Similarly, the inventory cost changes from age zero in 1948 to age five months by the end of 1949, increasing the above effect for the first year only. (Historical-cost income after tax averages 4.2% (1-40%) = 2.52% of sales.) In consequence of these tax effects, physical profit (and GPP profit, since there is no debt) overpredicts cash flows by 9.4% in the first year and 3.3% in the second year, with errors declining gradually thereafter to zero in the tenth year. The tax effects would be even more pronounced if the firm replaced equipment in a group or if it owned a building rather than renting one.

One other point worth noting in Figure 4 is the effect of income taxes on the errors for nominal profit. While the dollar errors are the same as they were for Firm 1, the percentage errors are much higher. Before-tax cash flows are approximately 2.7% of sales for both firms, but after-tax cash flows are only 1% of sales for Firm 4. Consequently, the after-tax errors for nominal profit are approximately 2.7 times as large as the before-tax errors, averaging 172% of cash flows.[6]

Final Research Design

If any performance attribute is indeed relevant for predicting cash flows, we would at least expect it to produce unbiased errors in a real-world context. That is, positive and negative errors would be offsetting over time. We have already shown that nominal profit is generally biased and, furthermore, that both nominal profit and GPP profit have variable biases for firms having debt financing. Physical profit, however, being unbiased under conditions of uniform price changes, could also be unbiased under conditions of the irregular price changes experienced by real-world firms. Accordingly, our final hypothesis,

$$H_0:\ E_t = \text{physical profit}_t \left(\frac{\text{net capacity}_t}{\text{net capacity}_{t-1}}\right) - \text{cash flow}_{t+1} = 0,$$

is first tested for the condition,

$$\text{BIAS} = \frac{\Sigma E_t/\text{sales}_{t+1}}{\Sigma \text{cash flow}_{t+1}/\text{sales}_{t+1}} = 0.$$

The particular specification for BIAS is intended to give a more representative indicator of "mean error" than would the mean of the individual percentage errors which could be distorted by cases of the cash-flow denominator being near zero. This point is further explained in the next section.

But unbiasedness may not be a sufficient condition for predictive relevance. If successive prediction errors ranged from +50% to -50%, with a zero bias, such predictions could nevertheless lead to decisions that were consistently uneconomical. Although we suggest below how the problem of such absolute deviations might be avoided, we also feel that it is important to estimate the approximate magnitude of such deviations. Consequently, we also test the predictive relevance of physical profit for the more ideal condition,

$$\text{DEV} = \frac{\Sigma \text{ABS}(E_t)/\text{sales}_{t+1}}{\Sigma \text{cash flow}_{t+1}/\text{sales}_{t+1}} = 0.$$

And, as a further test of our earlier logic, we also present the BIAS and DEV statistics for nominal profit and GPP profit.

In the final simulation, we increase external validity by using six empirical price series, rather than the assumed price changes of the pilot simulations above. Intended to approximate the operations of a retail clothing store,[7] the simulation uses the following as data inputs.

1. Retail prices: Men's and Boy's Apparel
2. Wholesale prices: Textile Products & Apparel
3. Equipment prices: Machinery & Equipment
4. Hourly wages: Wholesale Trade Workers[8]
5. Interest rates: Average Yields on Corporate Bonds, Moody's
6. Consumer Price Index (for testing GPP profit)

These series are gathered from various governmental agencies by the National Bureau of Economic Research (NBER) for conversion to machine-readable form. The agent for the data used in this study is Citibank in Chicago.

The first four input series are shown in Figure 5, recomputed so that all the 1948 indices equal 100. An iterative scaling procedure converts the first three indices into "actual" prices which result in historical-cost ratios equal to those reported by Robert Morris Associates for cost of goods sold and depreciation expense. The wage rates are scaled to generate wages and administrative expenses such that the RMA profit-before-tax constraint is met. Interest rates are used only if the firm has to borrow due to negative operating cash flows. In all other respects, including income taxes equal to 40% of historical-cost income, the final simulation conforms to the conditions for Firm 4 above.

FINAL TEST RESULTS

Figure 5 shows that the prices effecting our hypothetical clothing store are not smooth series; they generally change by different percentages, and they sometimes change in different directions. As a result of these environmental factors, and in spite of internal stability, the cash flows of our clothing store are volatile. Figure 6 indicates that the worst year was 1950, when equipment prices, wages and wholesale prices all increased while selling prices fell. In 1952, average wholesale prices declined nearly 10% while selling prices continued to rise, resulting in positive cash flows. Higher gross margins allowed positive cash flows for the next twenty years. The three negative cash flows in the seventies are primarily due to labor costs rising faster than gross margins. (Historical-cost income was positive for these years.) Cash flows in 1975 were helped by a decrease in wholesale prices while all other prices continued to rise.

Although Figure 6 may not represent the cash flows of a specific real-world firm, it does suggest the difficulty one might have in predicting the cash flows of a real clothing store. This difficulty is indicated by the percentage errors of physical profit in Figure 7. Of the twenty-nine predictions, twelve are "off" by more than 50%, either positive or negative. Only five predictions are within 10% of the actual cash flow.

As anticipated above, the effects of several errors are exaggerated when the cash-flow denominators are near zero. This occurs three times in the 1970's, and the largest error as a percentage of cash flow is +6528% for 1975 predicting 1976. (Four errors had to be truncated for plotting within a ±200% scale.) As +2.31% of sales, however, this error is smaller than 1951 predicting 1952, which is -4.80% of sales (-243% of cash flow). Due to the near-zero denominator, GPP profit has similar large percentage errors, and nominal profit's 1975 prediction overestimates 1976 cash flows by 13396%. However, even when these distortions are eliminated by using the DEV statistic, the absolute deviations are significant for all three performance attributes. Comparative statistics are presented in Table 3.

The evidence provided by this final test supports the following conclusions on the predictive relevance of physical profit.

1. Accept BIAS = 0. The mean error is not significantly different from zero ($t = 0.32$, $\alpha > 0.35$).
2. Reject DEV = 0. The mean absolute deviation is significantly greater than zero ($t = 4.91$, $\alpha < 0.01$).

Both of the other performance attributes failed the DEV test, and, as expected, nominal profit has a significant positive bias. The nominal profit errors are generally smaller than they were for Firm 4, primarily because inventory purchase prices increased at an average rate of only 1.4%, as compared to 4% for Firm 4. In this case with no debt, the GPP bias is not statistically significant ($t = -0.65$, $\alpha > .25$).

The predictions are more conservative, however, primarily because the consumer price index rose more rapidly than inventory purchase prices.

Physical profit still appears to be an unbiased predictor of future cash flows, but any determination of its practical relevance for such predictions must also consider the absolute deviations. Although the pattern and the exact sizes would differ, similar large deviations would likely result from price changes in most other industries.

SUGGESTIONS FOR FUTURE RESEARCH

We see the major problem of the predictive relevance issue as finding a way to avoid the individual errors that result from changes in various causal factors, especially price changes that occur after the time of the prediction. One obvious approach would be to expand the prediction model to include forecasts of these individual price changes. Such a prediction model would also need to include weighting factors for the relative effects of changes in retail prices, wholesale prices, wages, fixed-asset prices and taxes. While we could do this _post hoc_, with the aid of perfect knowledge of the above case, the problem is significantly more difficult when one does not know the future price changes and their relative effects on the cash flows of a particular firm. We hope, however, that this study provides a helpful focus that can be used in combination with other research tools (e.g., regression and Box-Jenkins models) that have been developed in earlier studies of other types of predictive ability.

We also pose a second approach that could resolve a major part of this problem. Although it has received less attention in previous studies, we note that decision-makers are often concerned with _comparative_ predictions rather than with isolated predictions for a single firm. If the two firms being compared are subject to similar price changes, then the individual errors may also be similar. In such cases, a _ratio_ of the physical profits of two firms (both adjusted for changes in net capacity) should predict the ratio of the two firms' cash flows more accurately than we could predict the individual cash flows of either firm. It might be more suitable in some cases to use differential comparisons to predict differences in the two firms' cash flows. Either possibility seems more likely for comparative predictions within the same industry, but inter-industry tests might also yield interesting results. The advantage of this approach would be the use of a simpler prediction model that does not require forecasts of numerous non-accounting data.

While physical profit seems more relevant for predicting the firm's cash flows, it is also possible that nominal profit could be more relevant for predicting total nominal returns, including opportunity gains in market value, to the investor. This would require that market gains be related to the price changes experienced by the firm (ΔP). Some writers [e.g., Lintner] believe this is not the case, but it is an empirical question that has not yet been subjected to empirical testing. Initially, there would be two data limitations: supplementary current-cost data are not available for many years, and the researcher would have to rearrange these data even to obtain estimates of nominal profits. Subject to the reliability of these estimates, it may still be possible to gain some insights on this issue by using cross-sectional tests.

The same approach could be used for an initial investigation of a related issue. Investors may be interested in predicting their total "real" return on alternative investments, i.e., the nominal returns adjusted for changes in general purchasing power. For this purpose, GPP profit seems likely to have some relevance. We suggest the same type of cross-sectional market study for addressing this latter issue.

Finally, we should note that the apparent unbiasedness of physical profit in predicting cash flows may not be universally valid. With certain combinations of resources, replacement policy and financing policy, physical profit could be biased. In particular, it may be necessary to include a "backlog adjustment" for firms that own buildings or have non-uniform replacement of equipment. And this possibility might further depend on the firm's policy regarding internal and external financing. Simulation techniques can be helpful in investigating this issue.

SUMMARY

This study provides some evidence and some research suggestions on questions about the predictive relevance of alternative concepts of profit. The preliminary analyses and subsequent test results support the following conclusions.

(1) Nominal profit and GPP profit are not generally relevant for predicting a firm's cash flows. In addition to producing significant and variable absolute errors over time, both predictors are subject to significant and inconsistent biases across firms.

(2) The "net capacity" prediction model will generally produce the best predictions of future cash flows. (tentative)

(3) Physical profit will generally produce unbiased predictions of future cash flows. (tentative)

(4) Predictions based on physical profit are subject to absolute errors that are significant and variable. (tentative)

Our suggestions are concerned with further testing of the tentative conclusions for physical profit and the possibility that nominal profit and GPP profit could be relevant for predicting total return to investors, including nominal and "real" capital gains, respectively. For improving the prediction model, regardless of the criterion, we suggest the "comparative prediction" approach as well as an approach that includes forecasts of additional causal factors. The results of this study indicate that all of these issues are worth investigating.

COMMON FACTORS FOR PRELIMINARY SIMULATIONS

Environmental:

All prices change 4% per annum.
Stable product demand.

Resource Controls:

Cash balance distributed at year-end.
Stable inventory level (exact monthly replacement).
Stable equipment level (uniform annual replacement).
Building rent a constant percentage of sales.
No receivables or payables (except debt as below).

Ratio Constraints (RMA):

Cost of sales to sales	0.622
Equipment depreciation to sales	0.026
Building rent to sales	0.026
Profit (HC income) before tax to sales	0.042
Cost of sales to inventory	2.4

SPECIFIC FACTORS FOR INDIVIDUAL FIRMS

Firm	Dividends	Debt	Income Tax
1	cash flow	none	none
2	cash flow (after interest)	50% of 1948 assets; constant thereafter; 6% annual interest	none
3	nominal profit	zero initially; as necessary to pay dividends thereafter; 6% annual interest	none
4	cash flow	none	40% of historical cost income before tax

TABLE 1

COMPARATIVE RESULTS WITH ALTERNATIVE SPECIFICATIONS OF "OPERATING LEVEL"

Predictions	Mean Error, Given Operating Level: Total Assets	Net Assets	Gross Capacity	Net Capacity
Physical profit for Firm 2's cash flows	-1.09%	+0.62%	-1.09%	-0.04%
Nominal profit for Firm 3's dividends	+1.36%	-2.54%	+1.36%	-1.15%
Physical profit for Firm 3's cash flows	+2.23%	-1.70%	+2.23%	-0.33%

TABLE 2

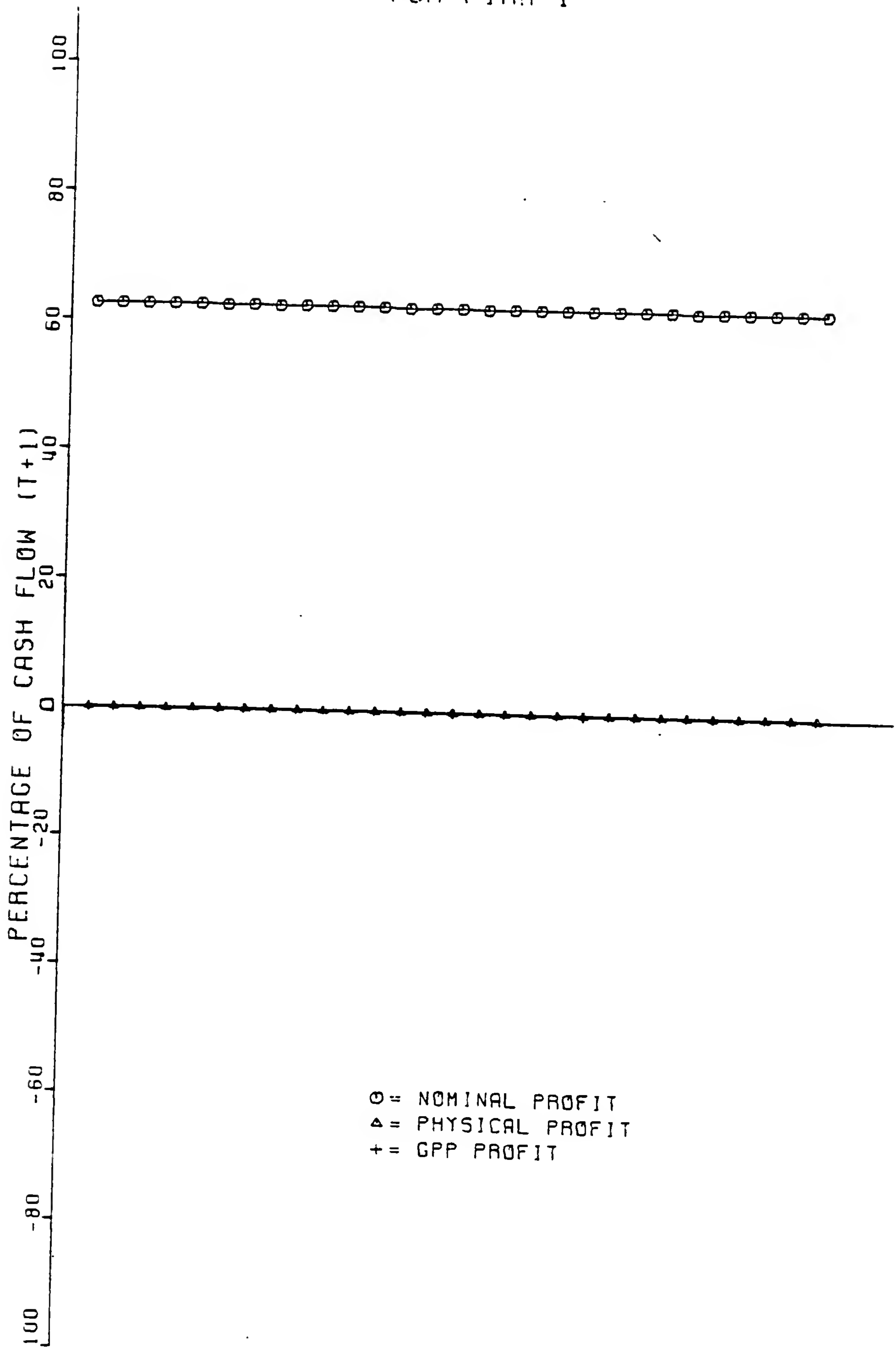
COMPARATIVE TEST STATISTICS
FOR PREDICTIVE RELEVANCE

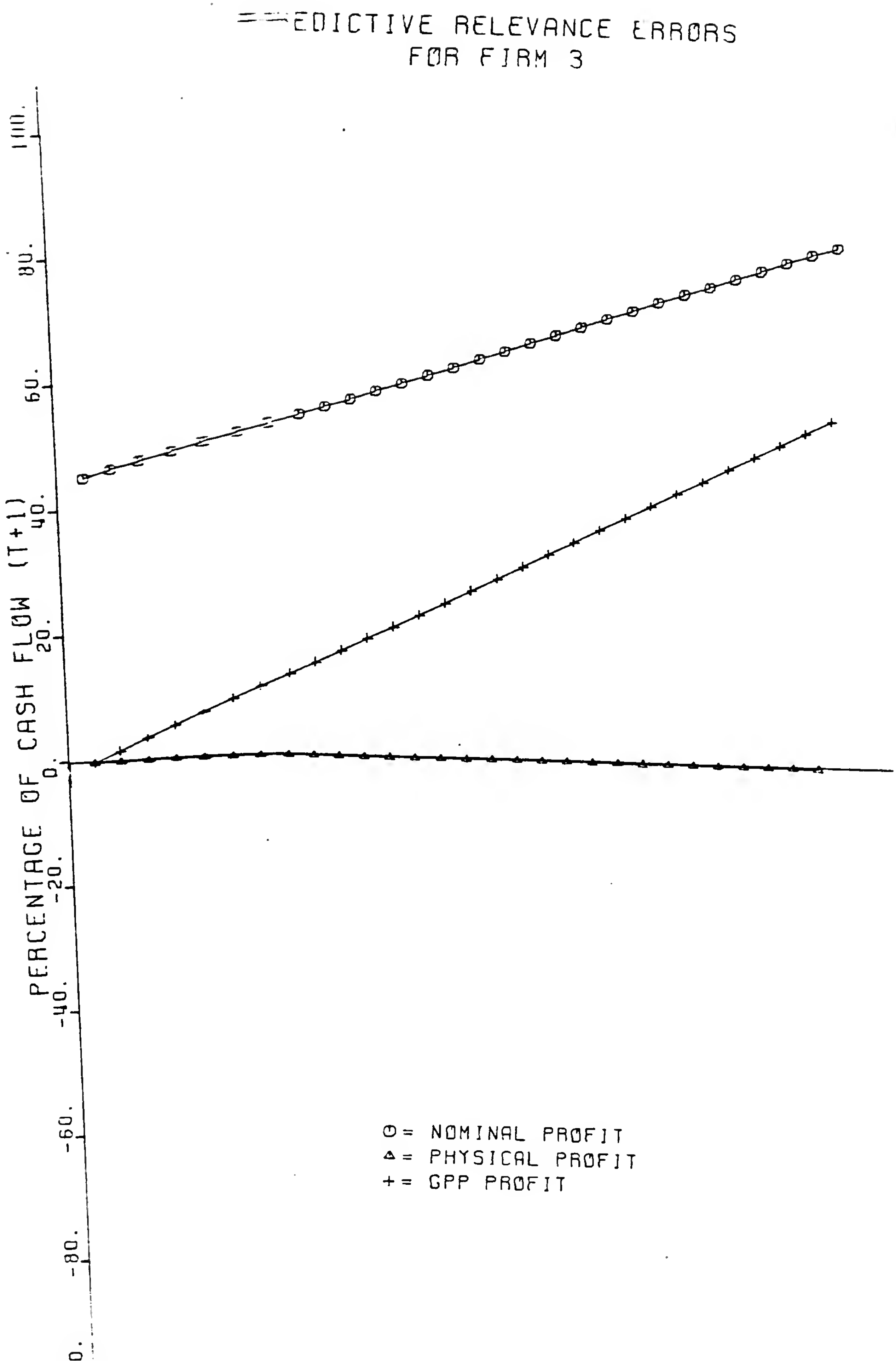
Performance Attribute	BIAS	DEV
Nominal profit	+65%*	111%*
Physical profit	+6%	72%*
GPP profit	-17%	96%*

*Significant at $\alpha < .01$

TABLE 3

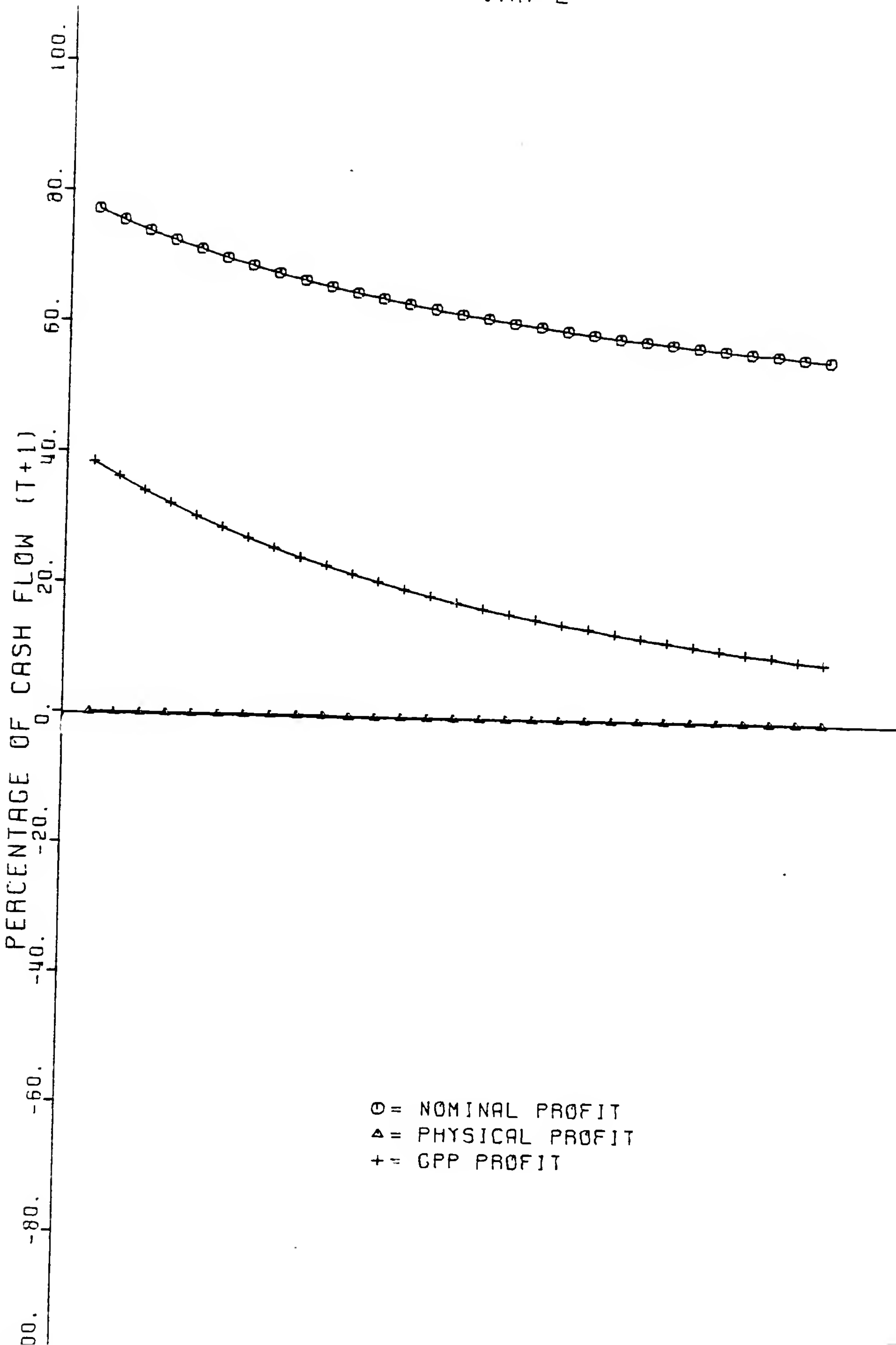
PREDICTIVE RELEVANCE ERRORS
FOR FIRM 1



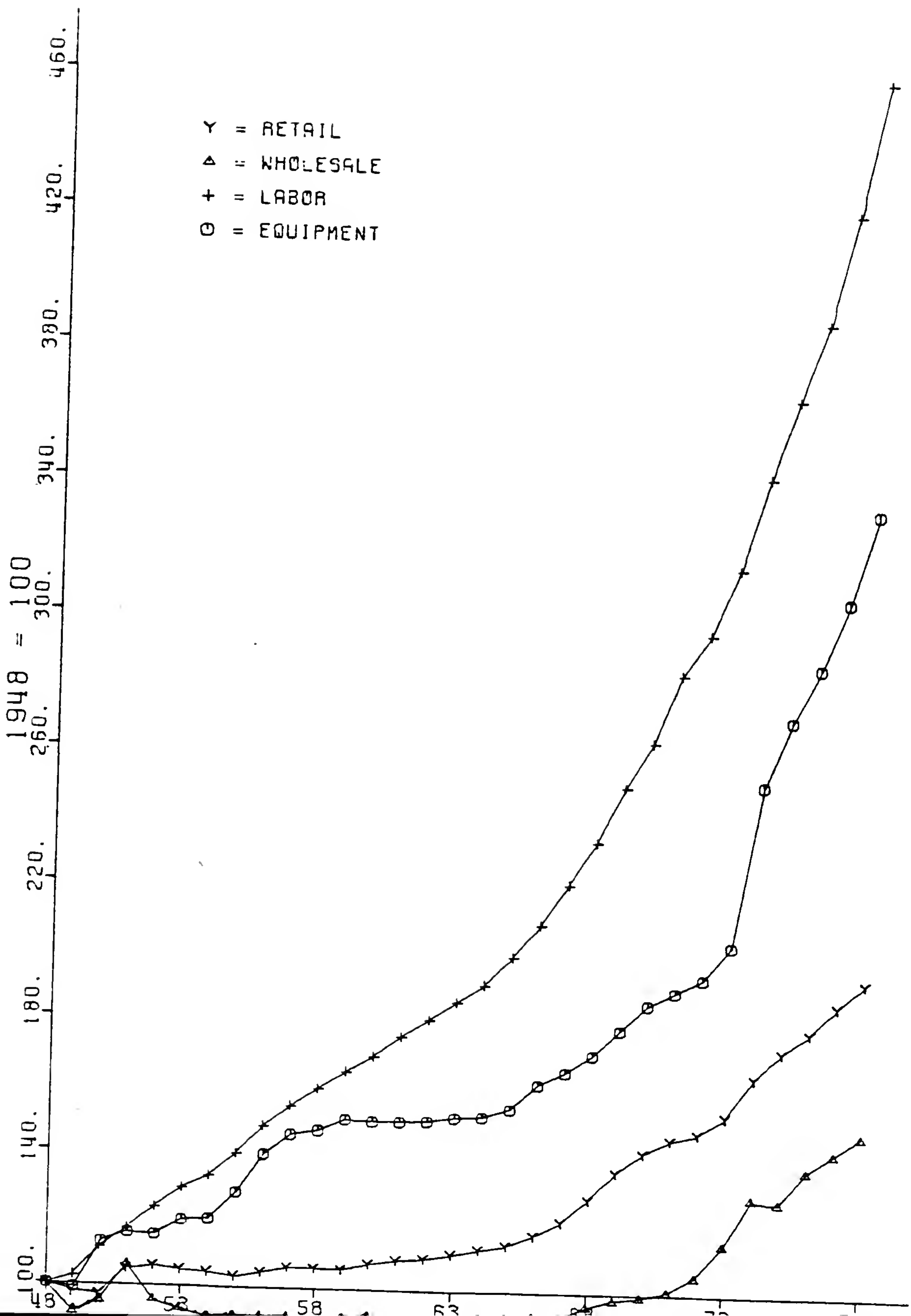


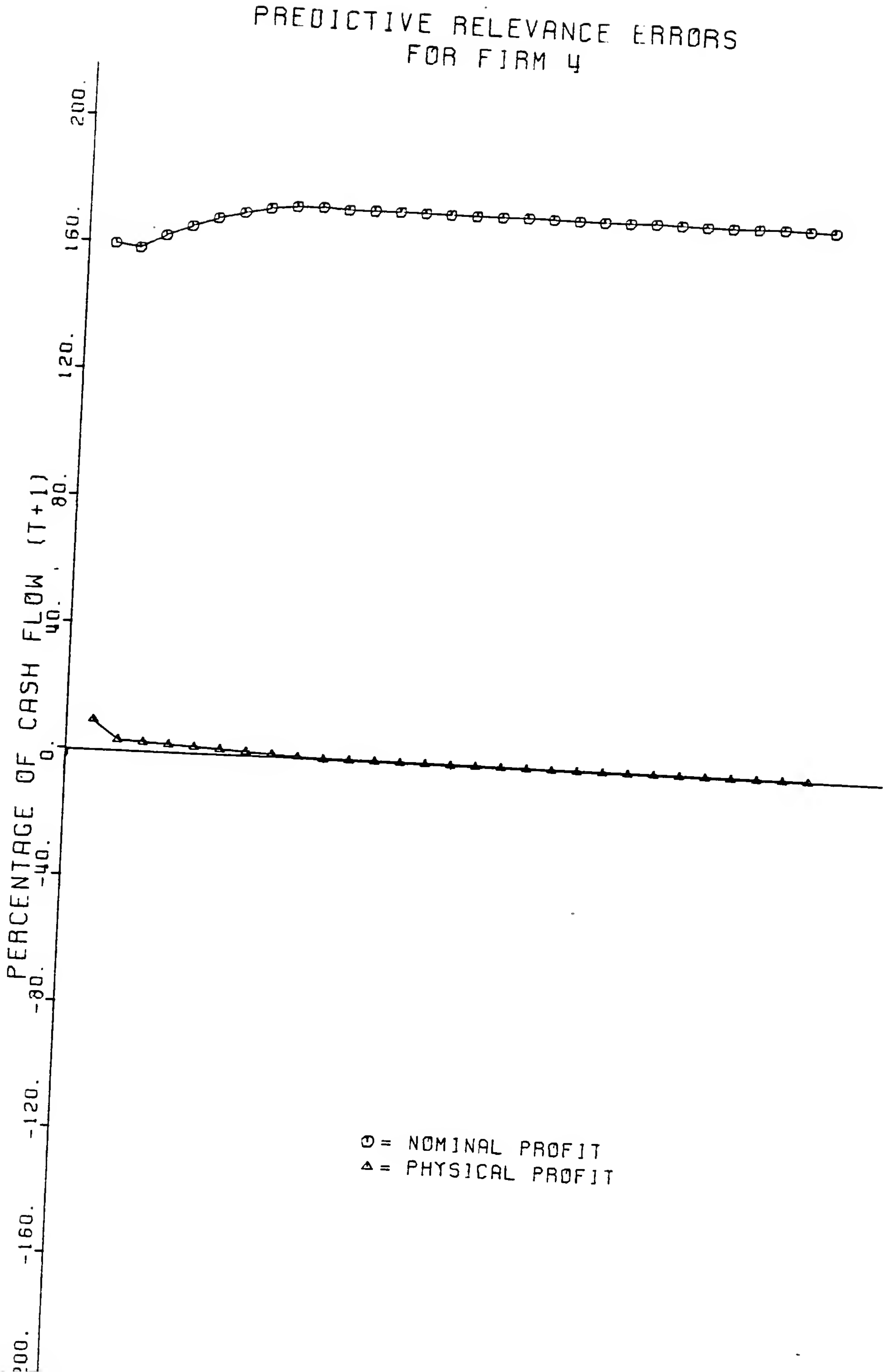
==EDICTIVE RELEVANCE ERRORS
FOR FIRM 3
PERCENTAGE OF CASH FLOW (T+1)
100.
80.
60.
40.
20.
0.
-20.
-40.
-60.
-80.
0.
Φ= NOMINAL PROFIT
Δ= PHYSICAL PROFIT
+= GPP PROFIT

PREDICTIVE RELEVANCE ERRORS
FOR FIRM 2

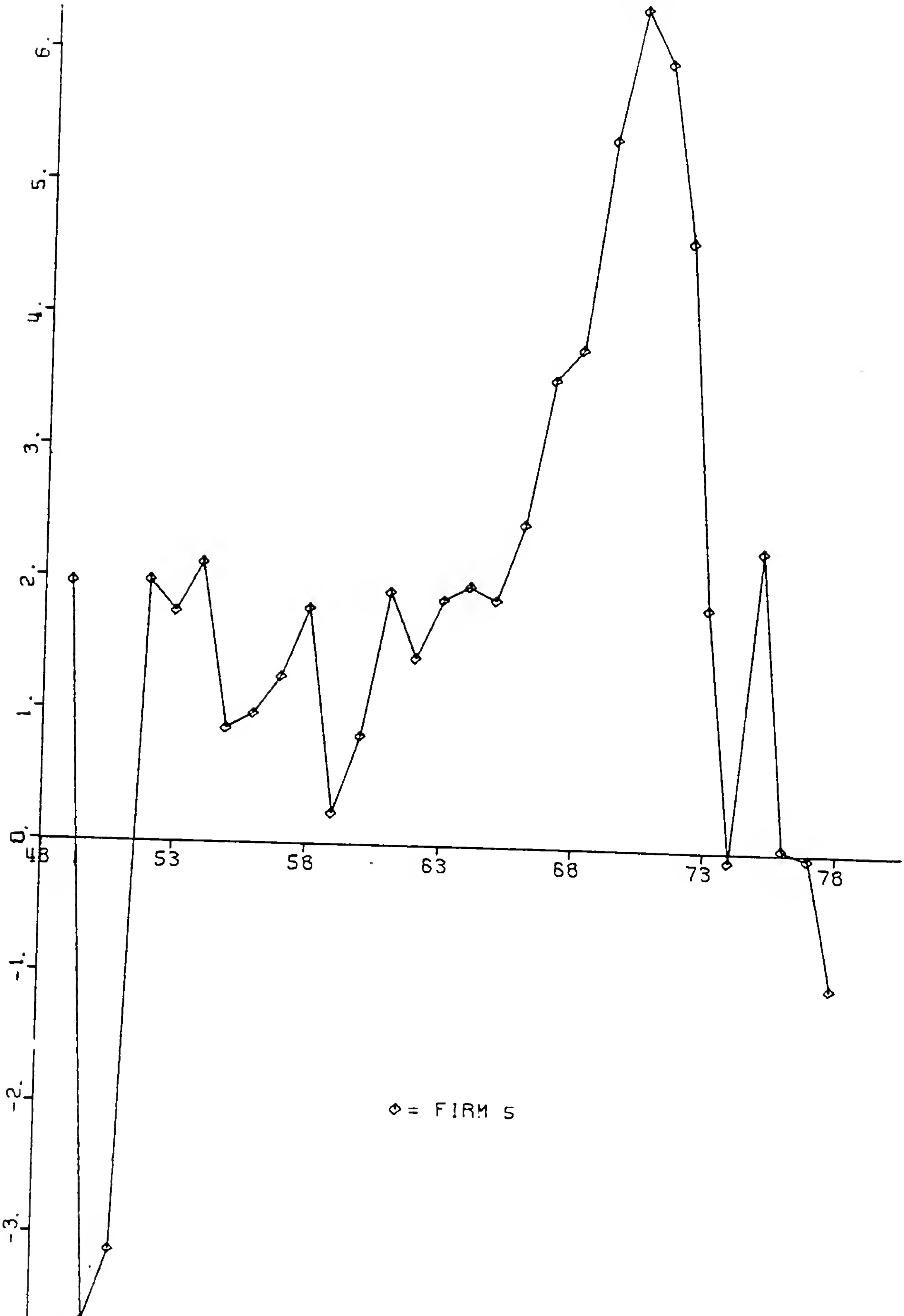


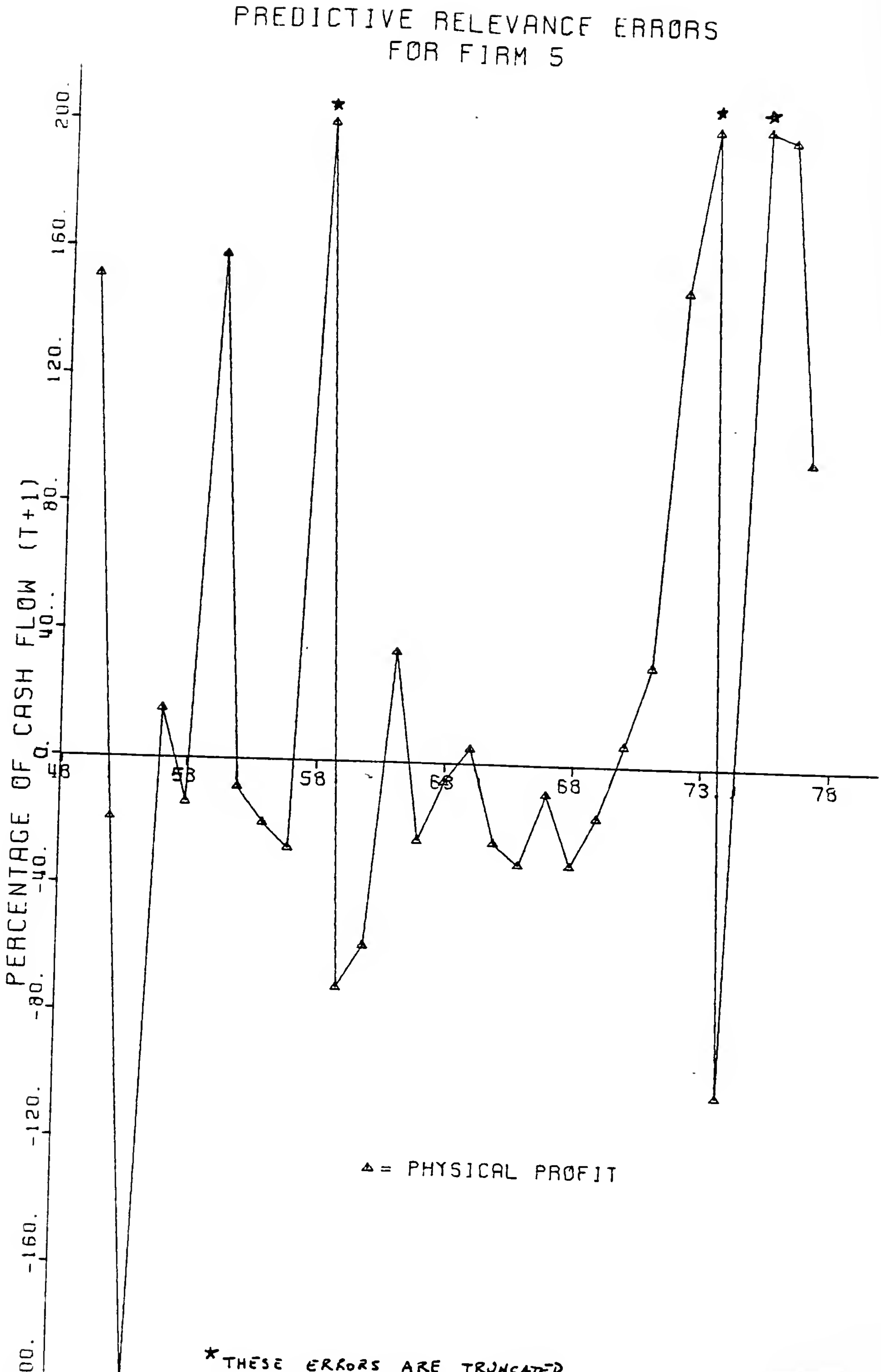
PRICE INDICES




PREDICTIVE RELEVANCE ERRORS
FOR FIRM 4
PERCENTAGE OF CASH FLOW (T+1)
200.
160.
120.
80.
40.
0.
-40.
-80.
-120.
-160.
-200.
= NOMINAL PROFIT
= PHYSICAL PROFIT

CASH FLOW AS A
PERCENTAGE OF SALES





PREDICTIVE RELEVANCE ERRORS
FOR FIRM 5
PERCENTAGE OF CASH FLOW (T+1)
200.
160.
120.
80.
40.
0.
-40.
-80.
-120.
-160.
48
53
58
63
68
73
78
△ = PHYSICAL PROFIT
* THESE ERRORS ARE TRUNCATED.

FOOTNOTES

[1]Sharp [1978, Ch. 9] shows several conditions under which COP tends to overestimate physical profit when prices are rising. Note that, although COP has often been advocated for estimating "distributable (physical) profit," Edwards and Bell did not express such an intent.

[2]We do not debate here the relative merits of alternative indices of "general price level." Instead we assume that the FASB's choice of CPI [Exposure Draft, p. 8] is reasonable.

[3]One source of differences is when "Real Business Profit" is expressed in "average of period dollars."

[4]We are aware of analytical valuation models that presume knowledge of future cash flows without indicating how to predict such flows. We are also aware of numerous empirical studies showing past correlations between stock returns and reported (historical-cost) earnings per share. But none of these is pertinent to predicting cash flows to a firm (or returns to investors) on the basis of non-reported performance attributes.

[5]Use of such a "low" rate does not affect the generality of our conclusions, but it does serve to highlight the magnitude of problems that can result from "small" price changes.

[6]The "kink" occurs in the upper plot because after-tax flows are higher in the first year than they are in the second year, due to the tax effect of smaller "inventory profits" in the first year.

[7]Retail and wholesale price data are also available for the automobile and food industries during the same time span. The clothing industry was preferred because food stores have unusually high inventory turnover and automobile dealerships have significant service operations in addition to retailing operations. Data for other retail industries are available from 1953 or later years.

[8]Hourly wages for retail workers are only available for the last fifteen years of our study. Based on having a higher correlation than other wage rates for this last fifteen years, wholesale hourly wages were chosen as the best available surrogate for retail wages for the entire thirty years.

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Faculty Working Papers

INTERACTION BETWEEN MONETARY AND FISCAL POLICIES

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Notes

[1]We required the firms to be listed during the entire sample period. The Center for Security Price Research (CRSP) monthly tape was used to select NYSE listed firms. A firm was considered listed if it had monthly stock returns available for the entire sample period.

[2]The absolute percentage error is computed as the average of $\left|\frac{\text{Actual EPS} - \text{Predicted EPS}}{\text{Actual EPS}}\right|$. Since this error metric can be explosive when the denominator approaches zero we truncated errors in excess of ten to a value of ten. This operation was done for a very small percentage of the cases.